

ERDC/EL TR-00-3

Environmental Laboratory



**US Army Corps
of Engineers.**

Engineer Research and
Development Center

Terrestrial Invertebrates, Edwards Air Force Base, 1997

Gordon Pratt

March 2000

20000530 042

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

The findings of this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.



PRINTED ON RECYCLED PAPER

ERDC/EL TR-00-3
March 2000

Terrestrial Invertebrates, Edwards Air Force Base, 1997

by Gordon Pratt

University of California at Riverside
Department of Entomology
Riverside, CA 92521

Final report

Approved for public release; distribution is unlimited

Prepared for Edwards Air Force Base
Edwards, CA 93523

Monitored by Environmental Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

Engineer Research and Development Center Cataloging-in-Publication Data

Pratt, Gordon.

Terrestrial invertebrates, Edwards Air Force Base, 1997 / by Gordon Pratt ; prepared for Edwards Air Force Base ; monitored by U.S. Army Engineer Research and Development Center.

43 p. : ill. ; 28 cm. — (ERDC/EL ; TR-00-3)

Includes bibliographic references.

1. Arthropoda — California. 2. Invertebrates — California. 3. Insects — Environmental aspects — California. 4. Rare invertebrates. I. United States. Army. Corps of Engineers. II. Engineer Research and Development Center (U.S.) III. Environmental Laboratory (U.S.) IV. Edwards Air Force Base (Calif.) V. Title. VI. Series: ERDC/EL TR ; 00-3.
TA7 E8 no.ERDC/EL TR-00-3

Contents

Preface.	iv
1—Introduction.	1
Background.	1
Purpose and Scope.	2
2—Study Area and Methods.	3
Study Area.	3
Methods.	3
3—Results.	8
Background.	8
Distribution.	8
Toxic and Noxious Invertebrates.	12
4—Discussion.	13
References.	15
Appendix A: List of Invertebrates at Edwards Air Force Base from November 1996 through December 1997 by Locality and Date	A1

SF 298

Preface

Members of the staff at Edwards Air Force Base, Edwards, CA, are conducting a series of floral and fauna surveys to check for Federally - listed endangered or threatened species and to obtain information for an overall resource management plan. In previous years they have conducted surveys for tortoises, butterflies, birds, and eubranchipods (including tadpole, clam, and fairy shrimp). This report describes results of a survey for terrestrial macroinvertebrates conducted by Dr. Gordon Pratt, University of California at Riverside, during 1997 under Contract DACA39-39-96-0028. This report presents results from the second year of a 3-year study.

The contract was monitored by Dr. Andrew C. Miller, Aquatic Ecology Branch, Ecological Research Division, Environmental Laboratory, U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS. The study was conducted under the general supervision of Dr. Edwin A. Theriot, Chief, Aquatic Ecology Branch; Dr. Conrad J. Kirby, Chief, Ecological Research Division; and Dr. John Keeley, Acting Director, Environmental Laboratory.

During the publication of this report, Dr. Lewis E. Link was Acting Director of ERDC, and COL Robin R. Cababa, EN, was Commander.

This report should be cited as follows:

Pratt, Gordon. (2000). "Terrestrial Invertebrates, Edwards Air Force Base, 1997," ERDC/EL TR-00-3, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

1 Introduction

Background

Edwards Air Force Base (EAB) is located in the Mojave Desert in southern California near Los Angeles. Terrain on the base of potential value for terrestrial invertebrates and other organisms consists of sand dunes, dry open hills, valleys, dry lakes or playas, smaller claypans, and pools. Vegetation around the playas is saltbush scrub and around the pools and claypans is saltbush scrub, Joshua tree woodlands, cottonwood and willow thickets, and mesquite bosque. Playas and most pools are devoid of macrophytes (Branchiopod Research Group 1993). The uplands are composed largely of creosote bush scrub.

EAB personnel are conducting a series of floral and fauna surveys to check for Federally listed endangered or threatened species and to obtain information for a complete resource management plan. Previous surveys have been conducted on tortoises, butterflies, birds, and eubrachipods (including tadpole, clam, and fairy shrimp). Surveys are being done to obtain information on endangered, threatened, and common species to provide data for the proposed habitat management plan.

Desert invertebrates of the western Mojave are highly seasonal and dependent on rain during the winter and spring. In this desert everything depends on water and its availability. Many of the leaf litter species, such as Jerusalem and camel crickets, diptera, centipedes, and millipedes, occur at the soil surface only during moist months, which are usually between November and March or April. During the rest of the year, they are buried deep within the soil. Other invertebrates, such as butterflies, moths, leaf-feeding beetles, and herbivorous flies, follow the availability of their specific food plants and occur only when the plants are either leafing out or in flower. Many bees, wasps, beetles, and flies seem to seasonally follow particular nectar sources. Even though the desert may appear extremely dry during the hottest times of the year, it comes alive with invertebrates at night, such as large tenebrionid beetles, wasps, ants, spiders, scorpions, and solfugids. This behavior is a response to the hot drying effects of the desert sun. Because of the great morphological variation in invertebrates, particularly the insects, they are well adapted to the severe and often unpredictably changing environment of the desert.

The list of invertebrates at EAB is an active one and by no means complete. After the 1997 season over 300 new species were added to the list. Unfortunately, 1997 was a dry year, so this number was lower than expected. The 1998 season seems to have provided a greater number and higher diversity of invertebrates than either 1996 or 1997, due to the higher desert rainfall. The number of new species could be larger since one of the major groups, the Hymenoptera, might be underrepresented due to the difficulty of identifying them. Also specimens of one of the major groups of the Hymenoptera, bees, were lent out for identification and have not yet been returned, so actual names will not be available until these specimens have been examined to determine whether new species are present among them. Many of the bees therefore have been labeled by family and numbered by morphospecies.

Purpose and Scope

The purpose of this study was to conduct a four-season survey of terrestrial macroinvertebrates in major habitats at EAB. Work was conducted in 1996, 1997, and 1998. This report includes data from the 1997 survey.

2 Study Area and Methods

Study Area

Twenty-five localities were chosen to be surveyed in order to cover as much territory and habitats at the base as possible (Figures 1 and 2). Currently, the only region that has not been well-sampled is the eastern quarter of the base. This region is under higher security than other regions. Due to the complexity of arranging escorts for surveys in this region, several areas just outside of the base along the border were selected for the 1998 survey.

Each of these 25 localities of the 1997 season were defined from a central location with a 0.8-km (0.5-mile) radius to form an approximate circular border. These sites are described in Table 1.

Methods

Many of the species in the orders Coleoptera, Hymenoptera, Diptera, Lepidoptera, and Neuroptera have been examined by experts, so these groups were more accurately determined over that of the 1996 collection, and names have been updated. Spiders have also been examined by experts. These new and more accurate determinations will be provided in the final report for the survey.

All of the butterflies were identified by sight, since the author knows this group quite well. The remaining insects were identified to order and then family by the keys of Borror, De Long, and Triplehorn (1981). The insects within each family were organized by morphospecies. Those morphospecies were first identified by matching to previously identified species and morphospecies collected in 1996 at Edwards Air Force Base. The author identified the remaining species by utilizing keys and the Insect Collection at the Entomology Research Museum, Department of Entomology, University of California, Riverside, as described previously (Pratt 1998).

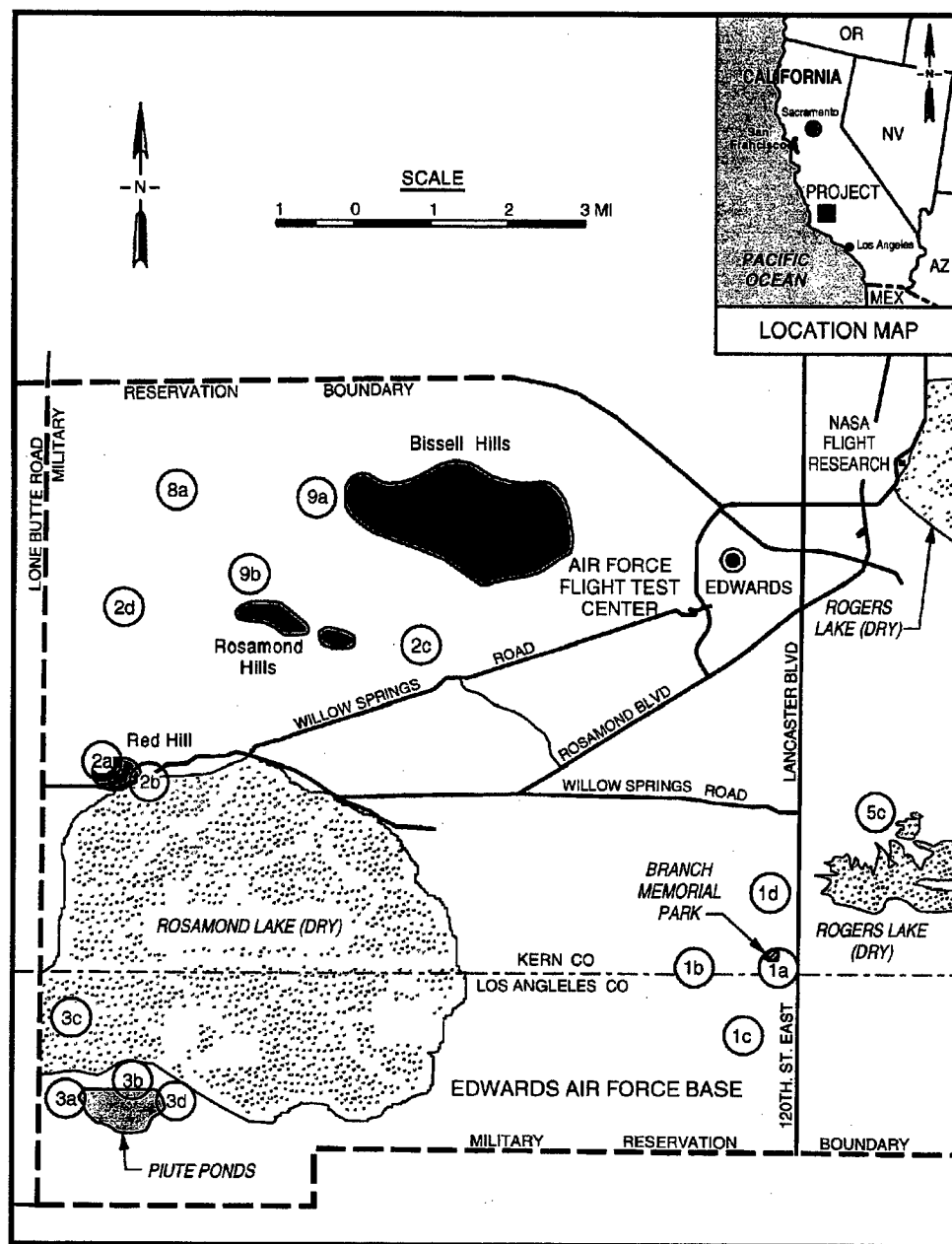


Figure 1. Field sites on EAB west (to convert measurements given in miles to kilometers, multiply by 1.6)

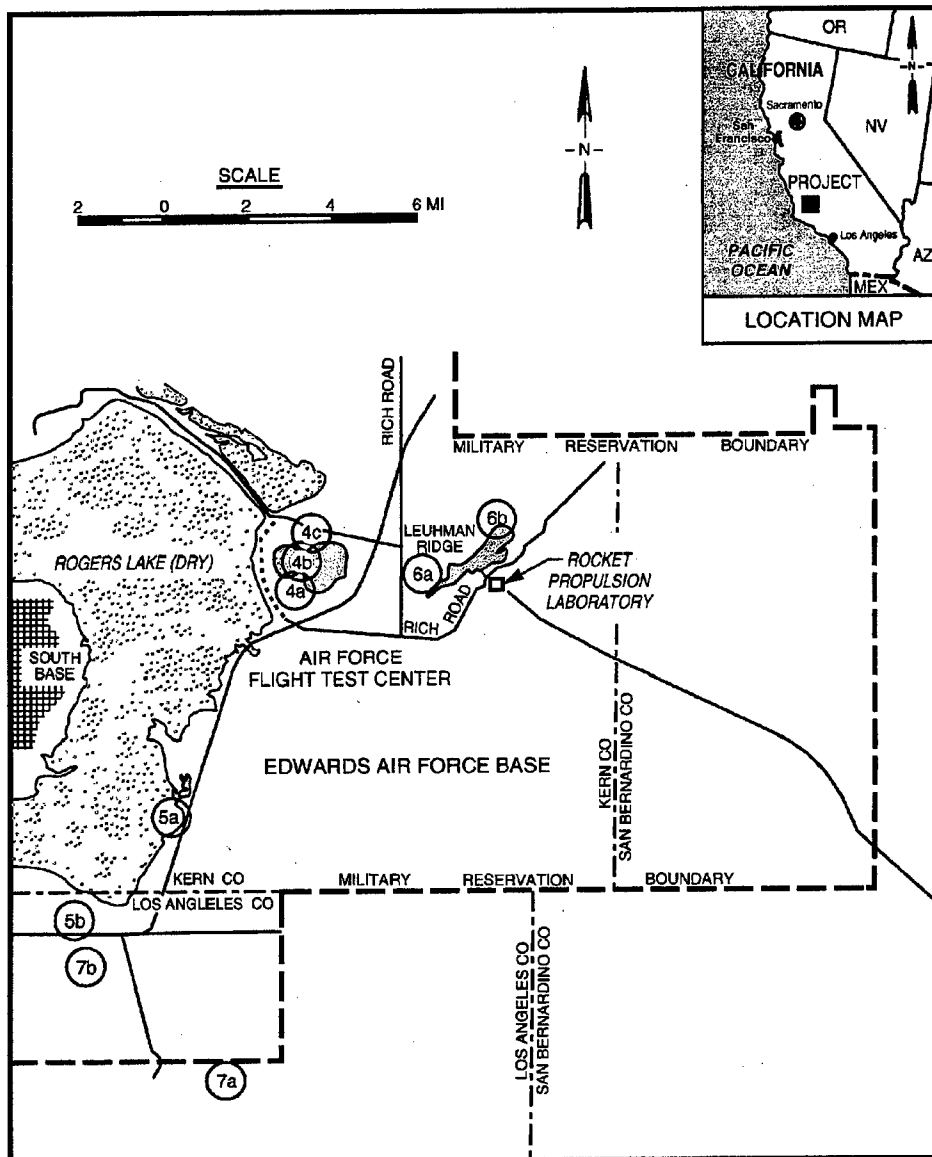


Figure 2. Field sites on EAB east (to convert measurements given in miles to kilometers, multiply by 1.6)

Table 1
Survey Localities

Locality	Description
1a	Branch Memorial park, areas around the pond, and the mesquite and cottonwood woodlands just to the north and west
1b	South end of Buckhorn Dry Lake, just 2 miles west of Branch Memorial park with a number of sand dunes and some mesquite (this locality contains the rare <i>As-tragalus preussii</i>)
1c	2 miles south of Branch Memorial Park with mesquite woodland
1d	2 miles north of Branch Memorial Park
2a	Red Hill, the hills just to the west, and the wash to the north
2b	Northwest end of Rosamond Dry Lake along the old paved road
2c	East end of Rosamond Hills
2d	2 miles northwest of Red Hill along Pole Line Road
3a	West side of Piute Ponds
3b	North side of Piute Ponds
3c	1.5 miles north-northwest of Piute Ponds
3d	East side of Piute Ponds
4a	About 1 miles north of Mercury Boulevard and 1 mile east of Rogers Dry Lake
4b	Near 4a on the peaks of the northeast side of Rogers Dry Lake
4c	1.5 miles northeast of the peaks
5a	Sand dunes 2.5 miles north of Avenue B on the west side of Mercury Boulevard
5b	Mesquite woodland just north of Avenue B just west of the intersection with 140th Street
5c	West side of the sewage ponds on the west side of Rogers Dry Lake
6a	1 mile north of Leuhman Ridge
6b	Hill area on the northeast side of Leuhman Ridge
7a	Just off base along the fence line directly south of Rogers Dry Lake (end of 165th Street)
7b	Area on the west side of 140th Street and south of B Street, which contains mesquite woodland
8a	Northwest corner of Edwards Air Force Base along Sopp Road 1 mile east of Pole Line Road
9a	Western side of Bissell Hills
9b	Western end of the Rosamond Hills

The Neuroptera (antlions and lacewings) were identified by Dr. Norm Penny at the California Academy of Sciences, Golden Gate Park, San Francisco, CA. The Odonata (dragonflies and damselflies) were identified by Dr. Rosser Garrison, Entomologist for Los Angeles County. The Macrolepidoptera (other than butterflies) were identified to species by Mr. Ron Leushner, Los Angeles County Natural History Museum. The Microlepidoptera were identified either to family, genus, or species by Dr. Jerry Powell, University of California at Berkeley. The Scarabaeidae of the Coleoptera were identified to species by Dr. Arthur Evans, Los Angeles County Natural History Museum. The Buprestidae of the Coleoptera were identified by Mr. Rob Velton, University of California at Riverside. The Meloidae of the Coleoptera were identified by Dr. John Pinto, University of California at Riverside. The Assilidae and Mydidae of the Diptera were identified by Mr. Dave Williams and Mr. Rick Viegas, University of California at Riverside Entomology Museum. The spiders were identified by Mrs. Richard Vetter, University of California at Riverside.

Some of the invertebrate identifications will be incorrect. Certainly the reliability will depend on the level of expertise of the identifier of that group. Identifications of the Lepidoptera, Neuroptera, and much of the Coleoptera for this reason are probably most reliable. The reliability of the identifications of those groups which the author identified and was least comfortable with may be somewhat questionable. Those groups, such as the grasshoppers, the genera of flies, and the ants, were identified by the author aided by various keys (Strohecker, Middlekauff, and Rentz 1968; McAlpine et al. 1981; Wheeler and Wheeler 1973). The advantage of identifying species to names, rather than just morpospecies, even though they may be incorrect, is that their identification gives some information on size, color, and general morphology of the specimens. But the most important factor for this study is not whether the identification is correct down to the species level, but whether the identification is consistent to morpho-species from one specimen to the next.

3 Results

Background

There were 769 invertebrates collected at EAB during the 1997 field season. Of these 769 species, nearly 40 percent (297) were new to this survey (Table 2), giving a grand total for the base of 1,270 species. As in last year's survey, over 80 percent of these invertebrates belonged to the four major orders: Coleoptera, Lepidoptera, Diptera, and Hymenoptera, whereas over 95 percent were of the eight major orders, which included in addition Orthoptera, Homoptera, Hemiptera, and Neuroptera. There were only slight differences between 1996 and 1997 in the percent totals of most invertebrates. These changes can be explained in part by changes in focus. For instance, since an expert in Macrolepidoptera was acquired for this study, there was an increase in the collecting of nocturnal Lepidoptera. This explains the highest number of new species (90) being Lepidoptera (Table 2). The next highest were Coleoptera (59), Diptera (54), Hymenoptera (43), and then Hemiptera (18).

One other group exhibited a high increase in diversity and new species. This was the spiders. Fifteen species of the 23 total spiders collected in 1997 were new. This number nearly doubled the record for spiders for the previous year. This increase was due to an increased search for spiders since it was a group that the author could also now have identified through an expert.

Distribution

Not all collecting sites visited in 1997 were comparable, since different factors seem to affect total number of species present. For example, of these 25 localities of the 1997 survey, only two sites, 1a and 3b, had more than 200 total invertebrate species collected, 455 and 347, respectively (Table 3, Appendix A). Both of these sites had bodies of permanent water and were surveyed over a 2-year period and for nocturnal invertebrates by mercury-vapor light. The next highest groups were sites 2c, 4a, and 5a (175-199), which were surveyed for nocturnal invertebrates as well as over a 2-year period. The group that was surveyed for nocturnal insects over a

Table 2
The Numbers of Invertebrate Species on Edwards Air Force Base, 1997

Species	1997 Total	New Species	Percent Total ¹	1996 Total	Grand Total	Percent Total
Spiders	23	15	2.0	19	34	2.7
Scorpions	1	0	0.0	1	1	0.1
Solpugids	1	1	0.1	0	1	0.1
Centipedes	1	1	0.1	0	1	0.1
Millipedes	2	1	0.1	1	2	0.2
Diplura	1	1	0.1	0	1	0.1
Thysanura	0	0	0.0	2	2	0.2
Ephemeroptera	1	0	0.0	1	1	0.1
Odonata	3	0	0.0	11	11	0.9
Orthoptera	26	2	0.3	41	43	3.4
Isoptera	0	0	0.0	1	1	0.1
Dermaptera	0	0	0.0	1	1	0.1
Psocoptera	1	1	0.1	0	1	0.1
Homoptera	31	11	1.4	34	45	3.5
Hemiptera	45	18	2.3	56	74	5.8
Thysanoptera	0	0	0.0	2	2	0.2
Neuroptera	10	0	0.0	20	20	1.6
Coleoptera	138	59	7.7	154	213	16.8
Trichoptera	1	0	0.0	4	4	0.3
Lepidoptera	151	90	11.7	135	225	17.7
Diptera	150	54	7.0	214	267	21.1
Hymenoptera	183	43	5.6	276	319	25.2
Total	769	297	38.6	973	1,270	

Note: Coleoptera, Lepidoptera, Diptera, and Hymenoptera = 80.8%

Orthoptera, Homoptera, Hemiptera, Neuroptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera = 95.1%

¹ Calculated as a percent of the new species (found in 1997) collected.

Table 3
Total and Endemic Species per Locality, Edwards Air Force
Base, 1997

Locality	Totals				Total Endemics ¹			
	1996	1997	New	Grand	Number		Percentage	
					1996	1997	1996	Total
1a ²	362	172	93	455	98	104	27.1	22.9
1b	75	26	16	91	12	9	16.0	9.8
1c	64	1	1	65	17	12	26.6	18.5
1d	nt	30	nt	30	nt	4	nt	13.3
2a	118	23	16	134	18	19	15.3	14.2
2b	67	4	2	69	9	9	13.4	13.0
2c ²	134	74	54	188	43	50	32.1	26.6
2d	nt	25	nt	25	nt	1	nt	4.0
3a	137	76	39	176	23	33	16.8	18.8
3b ²	293	154	54	347	103	102	35.2	29.4
3c	89	4	2	91	13	12	14.6	13.2
3d	nt	30	nt	30	nt	4	nt	13.3
4a ²	143	55	32	175	29	36	20.3	20.6
4b	55	17	10	65	8	12	14.5	18.5
4c	101	13	7	108	15	12	14.9	11.1
5a ²	195	9	4	199	46	34	23.6	17.1
5b	138	8	4	142	28	24	20.3	16.9
5c	100	4	1	101	16	14	16.0	13.9
6a ²	nt	146	nt	146	nt	26	nt	17.8
6b	nt	27	nt	27	nt	3	nt	11.1
7a ²	nt	174	nt	174	nt	28	nt	16.1
7b	nt	90	nt	90	nt	12	nt	13.3
8a ²	nt	160	nt	160	nt	23	nt	14.4
9a ²	nt	171	nt	171	nt	23	nt	13.4
9b	nt	21	nt	21	nt	0	nt	0.0

¹ The number of those species found only in that locality.

² Localities where night collecting by mercury-vapor light was done.

Note: nt = Data not taken for 1996.

1-year period was next highest (146-174). The lowest group, with some overlap, included sites that were surveyed only for diurnal insects for the 1997 season (21-90).

Water plays an important factor in numbers of species, since those for sites 1a and 3b were nearly double those of the other sites. Site 5c was an exception, since it has permanent water, yet had only 101 species present. Plants adapted to these bodies of water probably play a very large role, since there are no willows and cottonwoods and other mesic adapted plants at the sewage ponds on the southwest side of Rogers Dry Lake (site 5c). Two other factors play an important role in number of species present: (a) presence of mesquite woodland and (b) sand dunes. Species richness appears to be very high in mesquite woodland, and unique species appear to be high in sand dunes.

At least two basic criteria are important in determining the quality of an area and its value for preservation: the total number of species and the number of endangered organisms at the site. Certainly, determining the total number of invertebrate species in an area is not as difficult as determining the number of those that are endangered. California desert invertebrates are poorly known, and EAB is no exception. For this reason, very uncommon invertebrates that are not formally recognized as such on a State or Federal list are not easily recognized or identified and might even lack previous descriptions or names. Most California endangered invertebrates share one biogeographic characteristic: they exhibit restricted localized ranges; they are endemic to very small areas. The next best thing, therefore, would be to identify species that exhibit restricted ranges or occur only at one or two very similar localities within EAB. This will give some indication of the uniqueness of the habitat or site in question.

The species that exhibit restricted ranges (here called endemics) on EAB, i.e., unique species found only at one locality (Table 3, Appendix A), fall into two categories. One type is species with actual restricted ranges, and the other type is rare species with wide ranges that were not encountered at the other localities simply because they were rare. The first type denotes true endemics, while the second type is identified as unique to the locality due simply to sampling bias. Since such rare species exhibit wide ranges, their frequencies should be relatively constant from one locality to the next. Therefore, the number of endemics should be the total number of unique species at a locality minus a relatively constant frequency of rare species. Unfortunately, the constant frequency of rare species is not known, so the next best thing will be the number of unique species to a locality. With increased surveys over time, rare species should be encountered at multiple localities. Eventually the number of unique species will equal to the true endemics or the species with restricted ranges on base.

Unfortunately, some of the endemics with restricted ranges on base will be overlooked by this method. One reason will be that the sampling methods employed here simply do not obtain the species. There are many

nocturnal invertebrates that are not attracted to lights, many species with very short adult life spans, many that are too small for accurate identification, and many that are small and wingless. On the other hand, there are species that will be collected and not determined to be endemics or unique species, since they occur in more than one locality. The tiger beetles provide a good example. They are probably best thought of as endemics, since they are adapted to the salt flats around Piute Ponds; for this reason, these beetles were collected in localities 3a, 3b, and 3d. Another less dramatic example with a restricted range on base is *Apodemia palmeri*. This butterfly feeds specifically on *Prosopis glandulosa* and has a restricted range on base, but the plant is found at localities 1a, 1c, 5b, and 7b, which are all relatively close to one another. Since this species has been found at localities 1a, 1c, and 5b, it is by the selection method not considered an endemic.

As expected, the percent of total endemics dropped for most localities. Of the 15 localities surveyed during 1997, 12 had lower percent totals and only 3 exhibited higher totals (Table 3, Appendix A). One of these three, site 4a was only slightly higher, 20.3 percent versus 20.6 percent, while the other two, sites 3a and 4b, were 2 and 4 percent higher, respectively. It is not surprising for numbers at site 3a to have increased, since the area has much permanent water and is high in number of plant species unique to EAB, but the explanation for site 4b is not clear. In spite of the drop in percent endemics for all sites, their order in percent remained similar from one year to the next. For the five sites surveyed by mercury-vapor light, site 3b (north Piute Ponds) exhibited the largest percent endemics, site 2c was next, site 1a next, site 4a next, and site 5a last. Of these five sites, only site 5a fell below 20 percent and within the range of the other sites that were not nocturnally surveyed.

Toxic and Noxious Invertebrates

These were discussed in the 1996 survey (Pratt 1998). There are two spiders, at least two scorpions, a number of wasps, a number of biting flies, and probably at least one true bug. The two spiders are the black widow (*Latrodectus hesperus*) and the desert recluse (*Loxosceles deserta*). These two species can be avoided by wearing gloves when turning trash, rocks, logs, etc. The scorpions are nocturnal, so they can be avoided by wearing shoes at night and wearing gloves when turning over objects on the ground where they could be hiding. Most of the scorpions have only a mild sting and are not highly poisonous. The bug, which would be a *Triatoma* species, called a kissing bug (because it prefers to bite people on the lips), is a nocturnal bloodsucking insect that largely feeds on pack rats (*Neotoma* sp.). The flies belong to the families horseflies (Tabanidae), no-see-ums (Ceratopogonidae), mosquitoes (Culicidae), and black flies (Simuliidae). Most of these can be avoided by keeping clear of permanent water sources such as Piute Ponds and Branch Memorial Park. A number of the bees and wasps that occur on base can sting under certain conditions. Generally they can be avoided by staying clear of flowering bushes.

4 Discussion

A number of new and unique invertebrate species were found at the base during 1997. The Japygids and millipedes were largely collected during midwinter when the temperatures were cool and moist. Three Gryllacrididae were new for the base: one is a *Ceuthophilus* (camel cricket), another an *Ammobaenetes* (sand treader), and the third a *Stenoplematus* (Jerusalem cricket). The *Enchenopa permutata* (Membracidae) specimen found around the northwest corner of base may be a range extension for the species. The Phymatid, *Macrocephalus cimicoides*, is not common in the Mojave Desert. The author has not seen this species before. The family Phengodidae, of which *Zarhipis integripennis* is a member, was collected on base and is usually considered uncommon to rare. The *Euphilotes bernardino*, although common along the desert edge, is not well known for the western Mojave. The larvae of this species feed specifically on the flowers and seeds of the California buckwheat, *Eriogonum fasciculatum*. This butterfly was searched for over the past 3 years and was thought to be absent from the base. It was eventually found at two localities, one west of Red Hill and the other along the south end of the base. The *Apodemia mormo* near *virgulti* has been previously recorded only along the desert edge above the 914-m- (3,000-ft-) elevation. The Red Hill localities are a major range extension for the species. A new species of Assilidae was collected from the base, a *Cerotainiops* at site 7b. These have been collected both in 1996 and 1997. The Asteiidae, of which *Astiosoma aridum* is one, are thought of as very rare flies. An unusual wingless tipulid, *Dactylolabis vestigipennis* (or *damula*) was collected in the sand dunes on the eastern end of the Rosamond Hills. A few *Gasteruption nevadae*, which are also considered quite rare, were collected at site 7a on the southern edge of base.

Certainly it will be interesting to see whether the strong differences in species diversity are more strongly correlated with differentiation of locality or seasonal conditions. Around 40 percent of the species collected this year were new, despite the eventual low seasonal rainfall. The 1998 season provided a much higher precipitation. It will be interesting to determine if there will be more new species at localities that were surveyed last year or more new species localities not surveyed the previous year. These differences may be important for determining how to survey for new invertebrates on base in future years. It could be, for instance, more important to concentrate surveys on just a few sites that are diverse with different

habitats or cover as many sites as possible. Certainly, the highest diversities are found around areas of large bodies of permanent water. These areas, such as Branch Memorial Park and Piute Ponds, should be concentrated upon if only a few localities are chosen. There are many new species that are not being covered by this study. These groups are mainly the microhymenoptera and gallforming insects. New invertebrates not observed by any other means were collected by pitfall traps.

References

- Borror, D. J., De Long, D. M., and Triplehorn, C. A. (1981). *An introduction to the study of insects*. 5th ed., Saunders College Publishing, Philadelphia, PA, 928 pp.
- Branchiopod Research Group. (1993). "Eubranchiopod survey, Edwards Air Force Base, 1992-1993," University of San Diego, CA, 36 pp.
- McAlpine, J. F., Peterson, B. V., Shewell, G. E., Teskey, H. J., Vockeroth, J. R., and Wood, D. M. (1981). *Manual of Nearctic Diptera*. Supply and Services, Canada, Canadian Government Publishing Centre, Hull, Quebec, Canada, Vol 1-2, 1,332 pp.
- Pratt, G. (1998). "Terrestrial invertebrates of Edwards Air Force Base, 1996." Technical Report EL-98-18, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Strohecker, H. F., Middlekauff, W. W., and Rentz, D. C. (1968). "The grasshoppers of California," *Bull. Calif. Insect Surv.* 10, 1-177.
- Wheeler, C. G., and Wheeler, J. (1973). "Ants of Deep Canyon." The Regents of the University of California, 162 pp.

Appendix A

List of Invertebrates at Edwards Air Force Base from November 1996 through December 1997 by Locality and Date

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities¹</u>	<u>Date</u>
<u>Spiders</u>				
	Araneidae			
		* <i>Neoscoma oaxacensis</i>	3a	Jun 3
	Dictynidae			
		* <i>Dictyna palomara</i>	1a-b	Sep 6-Oct 20
		* <i>Tricholathys montereia</i>	3a	Jun 3
	Gnaphosidae			
		* <i>Drassyllus insularis</i>	3a	Jun 3
		* <i>Drassyllus fractus</i>	6a	Jun 13
		* <i>Gnaphosa synthetica</i>	3a	Jun 3
		* <i>Scopoides naturalisticum</i>	9a	Aug 2
	Mimetidae			
		<i>Mimetus hesperus</i>	3b	Aug 11
	Oxyopidae			
		* <i>Oxyopes tridens</i>	7a, 8a	May 7-13
	Philodromidae			
		* <i>Philodromus infuscatus</i>	3d	Apr 22
		* <i>Thanatus altimontis</i>	3a	Jun 3
		<i>Tibellus chamberlini</i>	3a	Sep 1
	Pholcidae			
		<i>Psilochorus</i> sp.	3a	Feb 26
	Salticidae			
		<i>Habronattus signatus</i>	1b, 7b, 9a	Aug 29-Sep 20
		<i>Pseudicius siticulosus</i>	3b	Sep 21

Note: Species preceded by asterisk are additions to list.

¹ See Table 1 (main text) for description of locality.

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Sicariidae			
		<i>Loxosceles deserta</i>	2a, 6a, 7a	Jan. 29-Oct 12
	Theridiidae			
		* <i>Diploena abdita</i>	5b	Jun 26
		<i>Euryopsis californica</i>	5b, 6a	Jun 13-26
		<i>Latrodectus hesperus</i>	2a, 5b	May 15-Jun 3
		* <i>Steatoda fulva</i>	2a, 7a	May 7-Jun 3
	Thomisidae			
		* <i>Misumenops deserti</i>	3a, 7b	Jun 3-Aug 29
		* <i>Misumenops importunus</i>	1a, 3b	Sep 6-21
		* <i>Xysticus aprilius</i>	6a	Oct 5
<u>Scorpions</u>				
		<i>Hadrurus</i> sp.	6a	Aug 22
<u>Solpugidae</u>				
		Species 1	3b	Jun 2
<u>Centipedes</u>				
		Species 1	2a	Jan 29
<u>Millipedes</u>				
		<i>Orthoporus</i> sp.	2a	Jan 29
		*Species 1	2a	Jan 29
<u>Insecta</u>				
Dipluran	Japygidae			
		*Species 1	2a	Jan 29
Ephemeroptera	Baetidae			
		<i>Baetis</i> species	1a	Sep 6
Odonata	Libellulidae			
		<i>Tramea onusta</i>	6a	Jun 13
		<i>Sympetrum corruptum</i>	7b	Oct 12
	Coenagrionidae			
		<i>Enallagma carunculatum</i>	1a, 3a-b, 3d, 7b, 8a	Aug 11-Sep 21

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
Orthoptera	Acrididae	<i>Anconia integra</i>	1d, 6a	Apr 8-Aug 22
		<i>Boottettix argentatus</i>	6a, 9a	Aug 2-22
		<i>Chimarocephala californica</i>	3a	Sep 21
		<i>Cibolacris parviceps</i>	6a	May 3-Jun 13
		<i>Cordillacris occipitalis</i>	6a, 8a, 9a	May 2-Aug 22
		<i>Hesperotettix viridis</i>	8a	Jul 16
		<i>Ligurotettix coquilleti</i>	7a	Aug 29
		<i>Melanoplus cinereus</i>	8a	Jul 16
		<i>Poecilotettix sanguineus</i>	9a	Aug 2
		<i>Psoloessa delicatula</i>	7b	Jun 29
		<i>Trimerotropis californica</i>	1a, 8a, 9a	Jul 16-Sep 6
		<i>Trimerotropis pallidipennis</i>	1a, 3a, 3d, 6a, 6b, 7a	Apr 8-Oct 5
		<i>Trimerotropis pseudofasciata</i>	3a, 3b, 7b, 8a, 9a	May 7-Oct 12
		<i>Trimerotropis rebellis</i>	6b, 8a, 9a	May 22-Aug 2
	Gryllacrididae	<i>Ceuthophilus</i> n. sp.	6a	May 2
		<i>Ammobaenetes</i> n. sp.	6a	May 2
		<i>Stenoplematus</i> n. sp.	1a	Feb 12
	Gryllidae	* <i>Oecanthus californicus</i>	3b	Sep 21
		<i>Gryllus assimilis</i>	1a, 3a, 6a, 7a, 9a	May 7-Sep 21
	Tettigoniidae	<i>Ateloplus luteus</i>	8a	Jul 16
		<i>Capnobotes fuliginosus</i>	7a	Jun 29
		<i>Neduba ovata</i>	7a	May 7
Dictyoptera	Mantidae	* <i>Iris orata</i>	3a	Aug 11-Sep 21
		<i>Stagmomantis californica</i>	7a, 8a, 9a	Aug 29-Sep 20
	Polyphagidae	<i>Arenivaga apache</i>	7a, 9a	Aug 29-Sep 20
		<i>Eremoblatta subdiaphana</i>	6a, 7a, 8a, 9a	Aug 2-Sep 20
Psocoptera	Trogiidae	*Species 1	3d	Sep 21
Homoptera	Acanaloniidae	*Species 1	8a	Sep 14
		*Species 1	6a, 9a	Sep 20-Oct 5
	Cicadellidae	<i>Aceratogallia californica</i>	1b, 3a, 3b, 7b, 8a	Feb 26-Nov 27
		<i>Acinopterus</i> sp.	1a	Apr 8
		<i>Ballana</i> sp.	1a	Apr 6
		<i>Empoasca fabae</i>	1a	Sep 6

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>Norvellina</i> sp.	7a	Jun 29-Aug 29
		<i>Opsus stactogalus</i>	1a, 1d, 3b, 3d, 8a	Apr 11-Oct 20
		<i>Scaphytopius irroratus</i>	1d, 2d, 6b, 7a, 8a	Aug 22-Oct 12
		<i>Texananus oregonus</i>	7a	Jun 29
		<i>Texananus</i> sp.	8a	Sep 14
		<i>Xerophloea peltata</i>	1d	Oct 20
		Species 4	2d, 8a	Sep 14
		Species 6	6a, 8a	Jul 16-Sep 14
		*Species 7	3d, 4b, 6a, 7b	Apr 22-Nov 1
		*Species 8	8a	Sep 14
		*Species 9	1a, 7a	May 7-Sep 6
		*Species 10	4a	Mar 5
		*Species 11	1a	Aug 6
		*Species 12	4c	Jul 5
		*Species 13	5a	May 15
	Cixiidae	Species 1	3a	Sep 21
	Delphacidae	<i>Delphacodes</i> sp.	3a	Sep 21
	Dictyopharidae	Species 1	9a	Sep 20
		Species 2	8a	Sep 14
	Flatidae	<i>Ormenis saucia</i>	7a, 8a	Aug 29-Sep 14
	Membracidae	* <i>Enchenopa permutata</i>	8a	Jul 16
		* <i>Micrutalis</i> sp.	6a, 7b	Jun 29-Aug 22
		<i>Multareoides bifurcatus</i>	3d, 6a, 7a, 7b, 8a, 9a	May 22-Oct 12
		<i>Multareis cornutus</i>	6a-b, 7a-b, 8a, 9a-b	May 3-Sep 14
	Psyllidae	Species 1	7a	Aug 29
Hemiptera	Anthocoridae	<i>Orius tristicolor</i>	1a-b, 5b, 6a-b, 7a-b, 8a, 9a-b	Jul 16-Nov 8
		*Species 2	9a	Sep 20
	Corixidae	<i>Corisella decolor</i>	1a, 3a-b, 6a, 7a, 8a, 9a	Apr 11-Sep 21
	Cydnidae	<i>Pangaeus congruus</i>	2c	Mar 27
	Largidae	* <i>Largus californica</i>	1a, 7b	Oct 12-20
	Lygaeidae	<i>Embethis vicarius</i>	9a	Aug 2
		<i>Geocoris pallens</i>	1a, 1d, 6a-b, 7a, 8a, 9a	Apr 8-Oct 20
		<i>Hadronema princeps</i>	1a, 2c, 9a	Mar 25-Apr 8
		<i>Lopidea confraterna</i>	3a, 6a-b	May 3-Sep 21

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>Lygaeas kalmii</i>	8a	May 13
		<i>Neocoryphus lateralis</i>	8a, 9a	Jul 16-Sep 20
		<i>Nysius tenellus</i>	1a-b, 1d, 3a-b, 3d, 6a, 7a-b, 8a, 9a-b	May 2-Oct 20
		<i>Parthenicus picicollia</i>	6a-b, 7a, 9a	Sep 20-Oct 12
		<i>Taylorilgus pallidulus</i>	1a, 1d, 3a-b, 3d, 6a-b, 7a-b, 8a, 9a	Apr 11-Oct 5
		*Species 1	1d	Oct 20
		*Species 2	1a-b, 2b, 3b, 6b	Apr 8-Oct 20
	Miridae			
		<i>Irbisia</i> species 1	9a	Mar 25
		<i>Phytocorus albidopictus</i>	8a	May 13
		<i>Phytocorus ramosus</i>	2c, 6a-b, 7a, 9b	Mar 25-Oct 12
		<i>Phytocorus</i> sp. 1	2c	Mar 25
		<i>Phytocorus</i> sp. 2	1b	Oct 20
		<i>Rhinocloa forticornis</i>	1b, 1d, 2b	Sep 6-Oct 20
		*Species 5	6b	Oct 5
		*Species 6	6a, 8a, 7b, 9a	Aug 29-Oct 5
		*Species 7	6a	Oct 5
		*Species 8	2a, 7a	Jan 29-Oct 12
		*Species 9	7a	Oct 12
		*Species 10	9a	Sep 20
		*Species 11	8a	Sep 14
		*Species 12	7b	Aug 29
		*Species 13	2d, 9a	Sep 14-20
	Nabidae			
		<i>Nabis americanoferus</i>	1a	Aug 6
	Pentatomidae			
		<i>Chlorochroa sayi</i>	1b, 1d, 8a	May 13-Oct 20
		<i>Dendrocoris contaminatus</i>	2d, 6a, 7a, 9a	May 2-Oct 12
		<i>Thyanta custator</i>	8a	Sep 14
	Phymatidae			
		* <i>Macrocephalus cimicoides</i>	9a	Sep 20
	Reduviidae			
		* <i>Apiomerus</i> sp.	6b, 7a, 8a	May 3-13
		* <i>Sinea complexa</i>	1a	Jun 6
		<i>Sinea diadema</i>	3a	Sep 21
		<i>Zelus renardii</i>	3a, 3d, 6a	Aug 29-Sep 21
	Rhopalidae			
		<i>Aufeius impressocollia</i>	1a, 7b	Aug 29-Sep 6
		<i>Arhyssus lateralis</i>	1a, 3a, 3d, 6a	May 2-Sep 21
		*Species 1	3b	Apr 11
	Saldidae			
		<i>Saldula pallipea</i>	3a	Nov 20
	Tingidae			
		<i>Corythucha morrilla</i>	1b, 2d, 3a, 8a, 9a	Sep 6-21

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
Neuroptera	Hemerobiidae			
		<i>Micromus variolosus</i>	9a	Sep 20
	Chrysopidae			
		<i>Chrysoperla plorabunda</i>	1a, 3a-b	Apr 11-Sep 21
		<i>Eremochrysopa tiabialis</i>	9a	Sep 20
	Myrmeleontidae			
		<i>Brachynemuris sackeni</i>	1d, 6a	Apr 8-Oct 5
		<i>Scotoleon carrizonus</i>	7a, 9a	Aug 29-Sep 20
		<i>Scotoleon fidelitus</i>	3a, 7a, 8a, 9a	Aug 29-Sep 21
		<i>Scotoleon longipalpus</i>	6a, 7a, 8a, 9a	Jul 16-Sep 20
		<i>Scotoleon minusculus</i>	7b	Aug 29
		<i>Scotoleon pallidus</i>	6a, 8a, 9a	Aug 2-Sep 20
		<i>Scotoleon singularis</i>	1a, 7b	Aug 29-Sep 6
Coleoptera	Anobiidae			
		<i>Xeranobium laticeps</i>	8a	Jun 6
		*Species 4	2c, 6a, 7a	Mar 25-May 7
	Anthicidae			
		<i>Anthicus punctulatus</i>	9a	Aug 2
		Species 1	3b, 7a	Jun 2-Aug 29
		*Species 2	7a	May 7
	Bostrichidae			
		* <i>Apatides fortis</i>	1a	Sep 6
		* <i>Scobicia</i> sp.	1a	Aug 6-Sep 25
	Bruchidae			
		<i>Algarobius prosopis</i>	1a, 7b	May 7-Oct 20
	Buprestidae			
		<i>Acmaeodera lanata</i>	7a	May 7
		* <i>Acmaeodera lucia</i>	9a	May 22
		* <i>Acmaeodera quadrivittata</i>	6a	Aug 22
		* <i>Acmaeodera sphaeralceae</i>	8a	May 13
		* <i>Anambodera santarosae</i>	6a	May 2
		* <i>Agrilus blandus</i>	2c	May 22
		* <i>Agrilus gibbicollis</i>	1b	May 22
		* <i>Chrysobothris atriplexae</i>	7b	May 7
		* <i>Chrysobothris deserta</i>	8a	Jul 16
		* <i>Chrysobothris lucana</i>	9a	Aug 2
		* <i>Chrysobothris pupureoplagiata</i>	7a	May 7
		<i>Hippomela oblitterata</i>	7a-b	Aug 29
		<i>Hippomela fulgida</i>	7b	Aug 29
	Carabidae			
		<i>Agonum funebre</i>	3a	Feb 26
		<i>Armara insignis</i>	1a, 2a, 2c, 3b, 9a	Jan 29-Nov 20
		<i>Bembidion bifossulatum</i>	3a-b	Feb 26-Apr 11
		<i>Bembidion variegatum</i>	3a	Feb 26-Aug 29
		* <i>Bembidion</i> sp.	1a	Aug 6

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>*Callisthenes lariversi</i>	2a	Jan 29
		<i>*Calosoma peregrinator</i>	2c	Mar 25
		<i>*Feronia isabellae</i>	3b	Nov 20
		<i>Harpalus lascivus</i>	3a	Feb 26-Sep 21
		<i>*Stenolophus flavipes</i>	3b	Apr 11
		<i>*Tetragonoderus pallidus</i>	1a	Apr 8
		Species 3	3a	Feb 26
	Cerambycidae			
		<i>*Aneflormorpha</i> sp.	6a	Aug 22
		<i>Crossidius suturalis</i>	3b	Aug 11
		<i>Derobrachus geminatus</i>	8a	Jul 16
	Chrysomelidae			
		<i>*Acalymma trivittata</i>	1a	Sep 15
		<i>Altica carinata</i>	7b	May 7
		<i>Chaetocnema ectypa</i>	1a	Sep 6
		<i>Diabrotica undecimpunctata</i>	1a, 3b	Sep 15-21
		<i>*Neochlamisus</i> sp.	8a	Sep 14
		<i>Pachybrachys desertus</i>	6a, 7a-b, 8a, 9a	Aug 22-Oct 12
		<i>Phyllotreta</i> sp.	1d, 9a	Sep 20-Oct 20
		<i>*Saxinus saucia californica</i>	4c, 9b	May 13-Jul 5
		<i>*Stenopodius</i> sp.	9a	May 22
		Species 2	1b, 2d, 8a, 7b, 9a	May 13-Sep 20
	Cicindelidae			
		<i>Cicindela haemarrhagica</i>	3b	Aug 11
		<i>Cicindela tranquebarrica</i>	3d	Sep 21
		<i>Cicindela willstoni</i>	3b	Apr 22-Jun 2
	Cleridae			
		<i>Cymatodera oblita</i>	7a	Aug 29
		<i>Cymatodera punctata</i>	9a	Aug 2
		<i>Phyllbaenus scaber</i>	6a, 9a-b	May 2-Aug 2
		<i>Trichodes ornatus</i>	2d, 6a	May 2-13
	Coccinellidae			
		<i>*Brumoides septentrionis</i>	8a	Jul 16
		<i>Coccinella novemnotata</i>	2c, 3b, 3d, 8a, 9b	Mar 25-Sep 21
		<i>Hippodamia convergens</i>	3b, 6a, 8a	Apr 22-Jul 16
		<i>Olla v-nigrum</i>	3b, 7a	May 7-Sep 21
		*Species 1	6a	May 2-Aug 22
		*Species 2	3d, 8a	Sep 14-21
		*Species 3	3a-b	Sep 21
	Curculionidae			
		<i>*Anthonomus</i> sp.	1b, 8a, 9a	Sep 6-20
		<i>Apleurus angularis</i>	7b	Aug 29
		<i>Ophryastes argentatus</i>	7a-b	Jun 29-Aug 29
		* <i>Ophryastes geminatus</i>	1a	Jan 13
		<i>Sibia setosus</i>	1a	Sep 6
		*Species 1	9a	May 22
		*Species 2	9a	Sep 20

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Dermestidae			
		<i>Anthrenus lepidus</i>	1a, 1d	Apr 8
		<i>Attagenus rutipennis</i>	2c, 9b	May 13-22
		<i>Cryptorhopalus apicale</i>	7a, 8a	May 7-13
		<i>Dermestes marmoratus</i>	9a	Aug 2
		*Species 1	2c, 7a, 9a-b	May 7-Jul 16
	Dytiscidae			
		* <i>Copelatus chevrolati</i>	3b	Apr 11
	Elateridae			
		* <i>Conoderus falli</i>	1a	Aug 6
		* <i>Horistonotus pallidus</i>	7a, 8a, 9a	Jun 29-Aug 2
		* <i>Horistonotus fidelis</i>	5a	May 15
		<i>Octinodes frater</i>	7a, 8a	May 7-13
	Helodidae			
		<i>Cyphon variabilis</i>	3b	Apr 11
	Heteroceridae			
		<i>Heterocerus gnatho</i>	3b, 7a	Apr 11-Aug 29
	Hydrophilidae			
		<i>Berosus</i> sp.	3b, 7a	Apr 11-May 7
		* <i>Enochrus</i> sp.	1a, 6a, 7a	Aug 22-Sep 6
		<i>Hydrophilus triangularis</i>	3b	Aug 11
		*Species 1	9a	Sep 20
	Meloidae			
		<i>Cordylospasta opaca</i>	2c	Mar 25
		<i>Lytta auriculata</i>	1a	Apr 8
		<i>Lytta stygica</i>	2c, 9a	Mar 25
	Melyridae			
		<i>Atalus oregonensis</i>	2c-d, 6a, 7a-b, 8a, 9b	May 7-Jul 16
		<i>Atalus difficilis</i>	4b	Sep 18
		<i>Atalus</i> sp. 1	8a	Jul 16
		<i>Atalus</i> sp. 2	7a	Jun 29
		<i>Tanaops lobulatus</i>	2c	May 22
		Species 4	1a, 1d, 6a, 7a-b, 8a, 9a-b	Mar 25-May 13
		Species 5	6a, 7a-b, 9b	May 2-13
		Species 6	8a	Jul 16
		Species 7	4a	Mar 5
		Species 8	4a-b, 6a, 8a	Mar 5-May 2
	Mordellidae			
		<i>Mordella albosutura</i>	2d, 6b, 7a-b	May 3-13
	Nitidulidae			
		Species 1	6a, 9a	Aug 2-22
	Oedemeridae			
		* <i>Oxacis</i> sp.	1a, 9a	Apr 8-Aug 2
		<i>Rhinoplatia ruficollis</i>	6a	May 3
	Phengodidae			
		* <i>Zarhipis integripennis</i>	2c	Mar 25

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
Scarabaeidae				
		<i>Aphodius lividus</i>	1a, 7a, 9a	Aug 29-Sep 20
		* <i>Coenonycha pallida</i>	4a	Mar 5
		* <i>Diplotaxis moerens</i>	7a	Aug 29
		<i>Diplotaxis subangulata</i>	6a, 7a, 9a	May 7-Aug 2
		* <i>Ligyris gibbosus obsoletus</i>	6a, 7a	May 3-Aug 29
		* <i>Paracotalpa ursina</i>	1a	Feb 12
		* <i>Polyphylla decemlineata</i>	7a	Jun 29
		*Species 1	7a	May 7
Staphylinidae				
		<i>Coproporus</i> sp.	7a	May 7
		Species 1	9a	Sep 20
		*Species 2	3b, 7a	Apr 11-Aug 29
		*Species 4	9a	Aug 2
		*Species 5	7a	May 7
Tenebrionidae				
		<i>Abolus verrucosus</i>	1a, 5a-b, 8a, 9a	Feb 12-Sep 6
		* <i>Agorporis</i> sp.	2a	Mar 29
		<i>Aloephus</i> sp.	7a, 9a	Jun 29-Aug 2
		<i>Apsena rufipes</i>	3b	Apr 22
		<i>Araeoschizus andrewsi</i>	3a	Apr 22
		* <i>Argoporia</i> sp.	2a	Mar 29
		* <i>Asidina</i> sp.	1a	Feb 12
		<i>Auchmobius picipes</i>	8a	May 13
		<i>Blapstinus pulverulentus</i>	1a	Apr 8
		<i>Coniontis ellyptica</i>	3d	Apr 22
		* <i>Coniontis parviceps</i>	1a, 7a, 9a	Feb 12-Aug 2
		<i>Coniontis</i> sp.	2a, 9a	Jan 29-May 22
		* <i>Cryptoglossa muricata</i>	7a	May 7
		<i>Edrotes ventricosus</i>	1a-c, 4a, 5a, 8a	Feb 12-Sep 14
		<i>Eleodes armata</i>	1a, 2a, 3c, 7a, 8a, 9a	Jan 29-Sep 6
		<i>Eleodes</i> sp. 1	1a-b, 2c, 5a, 8a, 9a	Jan 13-Oct 20
		* <i>Eupsophus castaneus</i>	7a	May 7
		* <i>Eusattus dubius</i>	2c	Jan 29-Mar 25
		<i>Eusattus muricatus</i>	1a-b	Feb 12
		<i>Philolithus actuosus</i>	2a, 7a, 8a, 9a	Jan 29-Oct 12
		<i>Trogoderus costatus</i>	1a	Feb 12
		Species 1	3b, 8a	Jun 2-Jul 16
		Species 3	9a	Aug 2
		*Species 4	9a	Aug 2
Tricoptera				
	Hydropsychidae			
		Species 1	9a	Sep 20
Lepidoptera				
	Arctiidae			
		<i>Apantesis proxima</i>	3b	Apr 18-Aug 11

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Blastobasidae			
		*Species 1	4a	Mar 5
	Cochylidae			
		*Cochylini sp.	8a	Sep 14
	Coleophoridae			
		* <i>Coleophora</i> sp. 1	8a	Sep 14
		* <i>Coleophora</i> sp. 2	3a, 4a	Mar 5-Sep 14
		* <i>Coleophora</i> sp. 3	2c, 4a	Mar 5-25
	Cosmopterigidae			
		* <i>Stagmatophora iridella</i>	7a	May 7
	Cossidae			
		<i>Hypopta palmata</i>	6a, 9a	Aug 2-22
		<i>Comadia henrici</i>	6a	May 2
		<i>Givira mucida</i>	6a, 7a	May 7-Aug 29
	Gelechiidae			
		* <i>Arotsura</i> sp. 1	2c, 4a	Mar 5-25
		* <i>Arotsura</i> sp. 2	7s, 9a	May 7-Sep 20
		* <i>Aroga paulella</i>	4a	Mar 5
		<i>Chionodes abdominella</i>	3b	Jun 2
		* <i>Gnorimoschema coquillettellum</i>	9a	Sep 20
		<i>Lita incicur</i>	7a, 9a	Sep 20-Oct 12
		* <i>Lita puertella</i>	1a, 7a	Oct 12-20
		* <i>Lita</i> sp. 1	7a	Oct 12
		*Species 1	4a, 6a	Mar 5-Oct 5
		*Species 2	7a	May 7
		*Species 3	1a, 8a, 9a	Sep 14-Oct 20
		*Species 4	7a	Apr 8
	Geometridae			
		* <i>Eupithecia deserticola</i>	2c	Jan 29
		<i>Glaucina erroraria</i>	2c, 7a, 9a	Mar 25-Sep 20
		* <i>Glaucina baea</i>	7a	Aug 29
		* <i>Glaucina loxa</i>	8a	Jul 16
		* <i>Lithostege deserticola</i>	4a	Nov 1
		* <i>Lobocleta ossularia</i>	1a	Sep 25
		<i>Narraga timetaria</i>	8a	Sep 14
		* <i>Nasusina minuta</i>	2c	Mar 25
		* <i>Paraglaucina halstinoides</i>	9a	Sep 20
		<i>Perizoma custodiata</i>	2c, 4a	Mar 5-25
		<i>Plataea diva</i>	2c	Mar 25
		* <i>Semiothisa californiaria</i>	2c	Jan 29
		<i>Semiothisa colorata</i>	1a, 2c, 4a, 6a, 7a, 8a, 9a	Jan 29-Sep 14
		<i>Semiothisa cyda</i>	1b	Sep 6
		<i>Semiothisa excurvata</i>	8a, 9a	Jul 16-Aug 2
		<i>Singlochis perumbraria</i>	2c, 4a, 7a, 8a, 9a	Mar 5-Sep 20
		<i>Synchlora aerata</i>	3b	Jun 2
		* <i>Yermoia perplexa</i>	2c	Jan 29

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Hesperidae			
		<i>Atalopedes campestris</i>	3b	Aug 11
		<i>Helioptes ericetorum</i>	9a	May 22
		<i>Hylephleus phyleus</i>	3b	Aug 11
		<i>Polites sabulleti</i>	3b	Apr 18-Aug 11
		<i>Pseudocopaeodes eunis</i>	3a-b	Apr 18-Jun 2
		<i>Pyrgus communis</i>	9a	May 22
		* <i>Pyrgus scriptura</i>	9a	May 22
	Incurvariidae			
		* <i>Adela punctiferella</i>	4b	Mar 5
		* <i>Caucas trifascia</i>	4b	Mar 5
		* <i>Prodoxus sordidus</i>	4c, 8a	Mar 5-Sep 14
		* <i>Tegeticula paradoxa</i>	4c	Mar 5
	Lycaenidae			
		<i>Apodemia mormo deserti</i>	6a	Jun 13
		<i>Apodemia mormo</i> nr <i>virgulti</i>	2d	May 13
		<i>Brephidium exilis</i>	1a-b, 1d, 2c, 3a-b, 3d, 4a, 5a-c, 6a, 7a-b, 8a, 9a-b	Feb 26-Aug 29
		* <i>Euphilotes bernardino</i>	2d, 7a	May 7-13
	Noctuidae			
		<i>Agrotis ipsilon</i>	9a	Sep 20
		* <i>Abagrotis nefascia</i>	6a	May 2
		* <i>Abagrotis trigona</i>	7a	Aug 29
		* <i>Aseptis monica</i>	2c	Mar 25
		<i>Autographa californica</i>	4a	Mar 5
		* <i>Catocala aholibah</i>	2c	Mar 25
		<i>Copicuculia eulipes</i>	8a	Jul 16
		* <i>Copicuculia heinrichi</i>	2c	Mar 25
		* <i>Discestra fulgora</i>	2c	Mar 25
		* <i>Egira curialis</i>	2c	Jan 29-Mar 25
		* <i>Euxoa atomaris</i>	1a, 3a, 6a, 7a, 8a, 9a	Sep 14-Oct 20
		<i>Euxoa auxiliaris</i>	1a, 6a, 9a	Apr 8-Oct 5
		<i>Euxoa olivia</i>	1a, 3b, 4a, 7a	Oct 9-Nov 1
		<i>Euxoa reclusa</i>	1a, 4a, 7a	Oct 12-Nov 1
		* <i>Euxoa satis</i>	7a, 8a	Aug 29-Sep 14
		<i>Euxoa selenis</i>	1a, 2c, 3b	Mar 25-Apr 22
		<i>Euxoa serricornis</i>	2c, 6a	Mar 25-May 2
		* <i>Euxoa tocodyae</i>	1a	Apr 8
		<i>Heliothis zea</i>	3b, 6a	Aug 22-Oct 9
		<i>Helotropha reniformis</i>	3b	Jul 11
		* <i>Manruta elingua</i>	4a	Nov 1
		* <i>Oncocnemis augustus</i>	4a	Nov 1
		* <i>Peridroma saucia</i>	1a, 3b, 4a	Mar 5-Aug 11
		* <i>Ponomotia megocula</i>	4a, 6a	Mar 5-Oct 5
		* <i>Protygia biclavis</i>	4a	Mar 5
		* <i>Protygia enalaga</i>	1a	Apr 8

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>Protorthodes alfkeni</i>	1a, 3b, 7a, 8a	Aug 29-Oct 9
		* <i>Proxenus mindara</i>	3b, 7a	Aug 11-29
		<i>Pseudorthosia variabilis</i>	3b	Sep 21
		* <i>Rancora comstocki</i>	2c	Jan 29
		<i>Rhizagrotis albalis</i>	4a, 6a, 7a	Mar 5-May 7
		<i>Rhynchagrotis exsertistigma</i>	2c, 3b, 6a, 7a	Mar 25-May 7
		<i>Schinia separata</i>	8a	Sep 14
		* <i>Schinia erosa</i>	6a, 9a	Sep 20-Oct 5
		* <i>Schinia ligeae</i>	2c	Mar 25
		* <i>Schinia oleagina</i>	1a	Sep 25
		<i>Scotagramma fieldi</i>	1a, 4a, 5c	Oct 20-Nov 1
		* <i>Setagrotis radiatus</i>	6a	May 2
		<i>Spaelothis havilae</i>	1a, 2c, 6a, 7a	Apr 8-Oct 5
		<i>Spodoptera exigua</i>	3b, 4a, 7a, 8a, 9a	Aug 2-Nov 1
		<i>Spodoptera praefica</i>	1a, 4a	Mar 5-Oct 20
		* <i>Trichoclea postica</i>	1a	Apr 8
		* <i>Trichopolia dentatella</i>	6a, 7a-b, 9a	Sep 20-Oct 12
		<i>Tridepia nova</i>	3b, 6a, 9a	Jul 11-Aug 22
		* <i>Walterela ocellata</i>	2c	Jan 29
	Nymphalidae			
		<i>Danaus plexippus</i>	3b	Aug 11
		<i>Nymphalis antiopa</i>	3b	Jun 2
		<i>Vanessa annabella</i>	3b	Apr 18-Jun 2
		<i>Vanessa cardui</i>	4a-c	Mar 5
	Oecophoridae			
		* <i>Inga cretacea</i>	7a	May 7
		* <i>Pleurota albastrigulella</i>	2c	Mar 25
	Pieridae			
		<i>Anthocharis cethura</i>	3b, 4a-c	Feb 26-Mar 5
		<i>Artogeia rapae</i>	3b	Jun 2-Aug 11
		<i>Euchloe hyantis</i>	3b, 4a-c, 5a	Feb 18-Mar
		<i>Pontia protodice</i>	3a-b, 3d, 7b, 8a, 9a	Mar 25-Aug 11
	Plutellidae			
		* <i>Plutella nr albidorsella</i>	2c	Mar 25
		* <i>Plutella xylostella</i>	1a, 2c, 4a	Mar 5-Oct 20
		* <i>Ypsolopha delscatella</i>	6a, 8a	Sep 14-Oct 5
		* <i>Ypsolopha</i> sp. 1	2c	Mar 25
	Pterophoridae			
		*Species 1	2c, 4a, 6a, 9a	Mar 5-Sep 20
		*Species 2	2c	Mar 25
	Pyrallidae			
		* <i>Achyra</i> sp. 1	3b	Aug 11
		* <i>Alpheias</i> sp. 1	7a	Aug 29
		* <i>Amydria</i> sp. 1	3b, 7a	Jun 29-Sep 21
		* <i>Euchromius ocelleus</i>	1a, 3b	Aug 11-Oct 20
		* <i>Eumysia</i> sp.	3b	Sep 21
		* <i>Frechinia laetalis</i>	9a	Sep 20

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>Loxostege cereralis</i>	9a	Aug 2
		<i>Loxostege strictalis</i>	7a	May 7-Jun 29
		<i>Nomophila nearctica</i>	7a	Oct 12
		* <i>Passodena flavidorsella</i>	2c, 8a	Mar 25-Sep 14
		* <i>Pima abiplagiatella</i>	2c	Mar 25
		<i>Prorasea sideralis</i>	2c, 4a, 9a	Mar 5-Sep 20
		* <i>Pseudoschoenobius</i> sp. 1	4a	Mar 5-Sep 20
		* <i>Rhagea packardella</i>	6a	May 2
		*Species 1 (Phycitinae)	2c	Mar 25
		*Species 2 (Phycitinae)	6a	Aug 22
		*Species 3 (Phycitinae)	9a	Sep 20
	Saturnidae			
		<i>Hemileuca burnsi</i>	8a, 9a	Sep 14-20
	Scythrididae			
		*Species 1	8a	Jul 16
		*Species 2	8a	May 13
		*Species 3	7b	May 7
		*Species 4	9a	Sep 20
	Sphingidae			
		* <i>Hyles lineata</i>	1a	Apr 8
		<i>Euproserpinus phaeton</i>	2b, 3b, 5a	Jan 29-Feb 26
	Tineidae			
		<i>Acrolophus variabilis</i>	6a, 8a	Aug 22-Sep 14
		* <i>Acrolophus</i> sp. 1	2c, 3b	Aug 11-Sep 4
		* <i>Acrolophus</i> sp. 2	6a	Aug 22
		*Species 1 (Tineinae)	2c, 6a, 7a, 8a	Mar 25-Sep 14
	Tortricidae			
		* <i>Bactra macopiana</i>	3b	Jul 11-Aug 11
		* <i>Cydia latiferreana</i>	8a	Sep 14
		* <i>Eucosma</i> nr <i>totana</i>	8a, 9a	Sep 14-20
		* <i>Eucosma</i> sp. 1	9a	Sep 20
		* <i>Eucosma</i> sp. 2	8a	Sep 14
		<i>Ofatulena duodecemlineata</i>	7a	Aug 29
		<i>Phaneta</i> sp. 1	4a	Mar 5
Diptera				
	Agromyzidae			
		*Species 2	1a, 3b, 6b, 7b, 8a, 9a	Sep 6-Oct 5
		*Species 3	3b	Feb 26
	Anthomyidae			
		<i>Pegoya duplicata</i>	1a, 2a, 3a-b, 4c, 6a, 7a-b, 9a	Jan 29-Oct 20
		*Species 1	7a	May 7
		*Species 2	3b-c	Feb 26-Apr 22
	Anthomyzidae			
		<i>Anthomyza</i> sp.	3b	Feb 26-Nov 20
	Assilidae			
		<i>Cerotainiops</i> n. sp.	7b	Aug 29

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		* <i>Coleomyia</i> sp.	9a	Mar 25
		* <i>Comontella fallei</i>	4a	Nov 1
		* <i>Cophura timberlakei</i>	4b	Nov 1
		* <i>Cophura tunca</i>	6a	Oct 5
		* <i>Cophura vanduzeei</i>	1a	Oct 20
		* <i>Efferia albibarbis</i>	3b	Jun 2
		* <i>Efferia beneticti</i>	8a	Jul 16
		<i>Efferia candida</i>	8a	Jul 16
		* <i>Efferia deserti</i>	6a, 8a	May 3-13
		* <i>Heteropogon</i> sp.	9a	Sep 20
		* <i>Lestomyia sabulana</i>	2c, 9a	Mar 25
		* <i>Metapogon tricellus</i>	4b	Nov 1
		* <i>Stichopogon nr. fragilis</i>	1a	Sep 15
	Asteiidae			
		<i>Astiosoma aridum</i>	7b	May 7
	Bibionidae			
		<i>Philia orbata</i>	9a	Sep 20
	Bombyllidae			
		<i>Anthrax irroratus</i>	9a	Mar 25
		* <i>Aphoebantus desertus</i>	1a, 2c, 4a	Mar 5-Apr 8
		* <i>Aphoebantus marginatus</i>	1a, 6b	Apr 8-Jun 13
		* <i>Aphoebantus transitus</i>	4b	Mar 5
		<i>Apolysis druia</i> s	2d, 3b, 7a, 9a	Apr 22-Sep 20
		<i>Apolysis</i> sp. 1	1a, 1d, 2d, 7a-b	Apr 8-Oct 20
		<i>Chrysanthrax pertusus</i>	6b, 7b	Jun 13-Aug 29
		<i>Conophorus fenestratus</i>	9a	Mar 25
		<i>Geron nigripes</i>	1a, 1d, 6a, 7a-b, 8a	May 7-Oct 20
		<i>Hemipenthes eumenes</i>	1a, 2c, 9a	Mar 25-Apr 8
		<i>Lepidanthrax inauratus</i>	6b	Jun 13
		<i>Lordotus luteolus</i>	9a	Mar 25
		<i>Mithicomylia antecessor</i>	7a-b, 8a	Jun 29-Aug 29
		<i>Oligodranes trochilus</i>	4a, 9a-b	Mar 5-25
		<i>Pantarbes</i> sp. 1	2c, 4a, 9a	Mar 5-25
		<i>Paravilla syrtis</i>	6a-b	May 3
		<i>Poecilanthrax californicus</i>	6b, 7a	Oct 5-12
		<i>Villa agrippina</i>	1b, 3b-c, 8a	Apr 22-Sep 6
		<i>Villa andrewsi</i>	9a	Mar 25
		<i>Villa arenosa</i>	3b	Jun 2
		<i>Villa</i> sp.	7a	Jun 29
		*Species 1	1a	Sep 6
		*Species 2	8a	May 13
		*Species 3	4a	Mar 5
	Calliphoridae			
		<i>Bufolucilia silvarum</i>	3b	Apr 11
		<i>Calliphora terrae-novae</i>	5b	Feb 19
		<i>Pollenia rudis</i>	3b, 3d, 8a	Apr 11-Sep 21
		*Species 3	7a, 8a	Jun 29-Oct 12

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Cecidomyiidae			
		<i>Asphondylia</i> sp. 1	6a, 7a, 8a, 9a	May 7-Sep 14
		<i>Asphondylia</i> sp. 2	1a, 2a, 3b, 4a, 7a, 8a, 9a	Jan 29-Sep 21
		Species 1	2d, 3b, 6a, 7a, 8a, 9a	Aug 29-Oct 5
		*Species 2	1a, 1d	Sep 6-Oct 20
	Ceratopoginidae			
		<i>Culicoides</i> sp. 1	1a, 7a	May 7-Sep 6
		<i>Forcipomyia brevipennis</i>	1a, 3a, 8a, 9a	Sep 14-Nov 20
		*Species 1	7b	Oct 12
	Chironomidae			
		Species 1	1a, 3a-b, 3d, 7a	Apr 8-Sep 21
		Species 3	3b, 9a	Sep 20-Nov 20
		Species 4	1a, 3d	Apr 8-Oct 20
		Species 8	1a	Sep 6-Oct 20
		*Species 9	1a, 3b	Apr 11-Sep 6
	Chloropidae			
		<i>Ocella punctifrons</i>	2d, 6a, 7a-b	May 2-Aug 29
		<i>Siphonella</i> sp.	3b	Apr 11-Aug 11
		<i>Thaumatomyia rubida</i>	1a, 2d	Sep 6-14
		Species 4	1a, 3a-b, 7a-b, 8a	Feb 26-Nov 20
		Species 5	3b	Jun 2
		*Species 6	1a, 3b	Sep 6-21
		*Species 7	1a	Sep 6
		*Species 8	6a, 7a	May 2-7
		*Species 9	1a, 2d, 7a	Apr 8-May 13
		*Species 10	1a	Apr 8
	Conopidae			
		<i>Physocephala texana</i>	3b	Apr 11-Aug 11
	Culicidae			
		<i>Aedes varipalpus</i>	1a, 3a-b	Apr 11-Oct 20
		<i>Culex peus</i>	3a-b	Apr 11-Sep 21
		<i>Culiseta inomata</i>	6a, 9a	Sep 20-Oct 5
	Dolichopodidae			
		<i>Dolichopus consanguineus</i>	3a-b, 6a	Apr 11-Oct 5
		<i>Hydrophorus eldoradensis</i>	3a	Nov 20
		<i>Medetera</i> sp.	1a, 7a	Sep 6-Oct 12
		Species 1	1a	Sep 6
	Drosophilidae			
		*Species 1	1a, 6a, 9a	Sep 6-Oct 5
	Empidae			
		*Species 1	3a	Feb 26-Nov 20
	Ephydriidae			
		<i>Ephydra halophila</i>	3a-b	Sep 21-Nov 20
		<i>Mosillus tibialis</i>	1a-b, 1d, 3a-b, 6a, 7a	Feb 26-Nov 20
		<i>Psilo olga</i>	3a	Feb 26
		Species 1	3a	Feb 26-Nov 20
		*Species 3	3a, 6a	Aug 22-Nov 20

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Heleomyzidae			
		<i>Pseudoleria</i> sp.	2a, 3b, 9a	Jan 29-Mar 25
		*Species 2	1a	Oct 20
		*Species 3	4c, 9a	Mar 5-25
	Milichiidae			
		<i>Milichiella</i> sp. 2	1a, 1d, 2d, 3a-b, 6a, 7a-b, 9a	Feb 26-Oct 20
	Muscidae			
		<i>Limophora narona</i>	7b	Oct 12
		<i>Lispe</i> sp.	1a, 3a-b	Jun 2-Oct 20
		Species 4	1a	Oct 20
		Species 5	1a, 3a, 8a, 9a	Sep 6-21
		Species 7	1a, 3b	Sep 6-Nov 20
	Mycetophilidae			
		Species 1	1a	Oct 20
	Mydidae			
		* <i>Pseudonomo neuro</i>	7b	Aug 29
	Otitidae			
		<i>Euxesta</i> sp. 1	3b	Apr 11
		<i>Euxesta</i> sp. 2	3b	Jun 2
		<i>Euxesta</i> sp. 4	3b, 7b, 9a	Mar 25-Oct 12
		<i>Meliera similis</i>	3b	Jun 2
		<i>Physiphora demandata</i>	3b	Apr 22
	Richardiidae			
		*Species 1	7b	Oct 12
	Sarcophagidae			
		<i>Blaesoxipha plinthopyga</i>	1a, 6a, 7a-b, 8a	Apr 8-Oct 5
		<i>Blaesoxipha omani</i>	1a, 7a, 8a, 9a	Aug 2-Sep 20
	Scatopsidae			
		<i>Coboldia fuscipes</i>	3a-b	Apr 22-Nov 20
	Scenopinidae			
		<i>Metatrichia bulbosa</i>	2d, 6a, 7a-b	May 2-Aug 29
		Species 1	2d, 8a	May 13-Jul 16
	Sepsidae			
		<i>Sepsis neocynipsea</i>	9a	Sep 20
	Simuliidae			
		Species 1	7a	May 7
	Sphaeroceridae			
		<i>Leptocera formosa</i>	3a-b, 6a, 9a	Feb 26-Nov 20
	Syrphidae			
		<i>Ceriana</i> sp.	1a	Apr 8
		* <i>Eristalis alhambra</i>	3b	Aug 11
		<i>Eristalis latifrons</i>	3a-b	Aug 11-Sep 21
		<i>Eristalis tenax</i>	3b	Apr 22-Aug 11
		<i>Eupeodes volucris</i>	1a, 3a-b, 4a	Mar 5-Sep 21
		<i>Mesograptia marginata</i>	1a	Sep 6
		<i>Platycheirus stegnus</i>	1a	Apr 8

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>*Polydontomyia curvipes</i>	3b	Aug 11
		<i>Syrirta pipiens</i>	3b, 3d	Apr 11-Sep 21
	Tabanidae	<i>Chrysopa discalis</i>	3b	Apr 11-Aug 11
		<i>Tabanus punctuifer</i>	1a, 3a	Sep 6-21
	Tachinidae	<i>Merochaetina</i> sp.	1a, 4a, 6a, 7a, 8a	Mar 5-Oct 5
		<i>Peleteria malleola</i>	1a, 5a, 9a	Feb 19-Apr 8
		Species 1	9a	May 13
		Species 2	3a, 4a, 7a	Mar 5-Oct 12
		*Species 3	3c	Jun 6
		Species 4	1a, 3b	Apr 22-Sep 6
		*Species 5	1a	Jun 6
		*Species 6	9a	Mar 25
		*Species 7	3b	Apr 11-Aug 11
	Tephritidae	<i>Trupanea jonesi</i>	6a	May 2
		*Species 1	1a	Sep 6
		*Species 2	1a	Sep 6
		Species 3	1a, 3a, 9a	Sep 6-21
	Therevidae	<i>Thereva</i> sp. 1	1d, 3a, 4b	Mar 5-Sep 21
		<i>Thereva</i> sp. 3	1d, 7b	Apr 8-May 7
		* <i>Thereva</i> sp. 4	7a	May 7
		* <i>Thereva</i> sp. 5	8a	May 13-Sep 14
	Tipulidae	* <i>Dactylolabis vestigipennis</i>	2c	Jan 29
		* <i>Erioptera cana</i>	3b	Feb 26
		<i>Tipula</i> sp. 1	1a, 2c, 7b	Mar 25-May 7
		<i>Tipula</i> sp. 2	1a, 2c	Mar 25-Apr 8
		* <i>Tipula</i> sp. 3	2c	Mar 25
		* <i>Tipula</i> sp. 4	1b	Apr 8
		<i>Limnophila</i> sp. 1	3b	Jun 2
		*Species 1	3a	Feb 26
		*Species 2	1a	Sep 6
	Trioxscelidae	Species 1	1a, 2c, 4c, 9a	Mar 5-Apr 8
Hymenoptera	Andrenidae	Species 1	4a	Mar 5
		Species 2	3b	Apr 11
		Species 3	1a	Apr 8
		Species 4	3b, 8a	Apr 11-Aug 11
		Species 5	2c, 4b	Mar 5-25
		Species 6	4a-b, 9b	Mar 5-May 13
		Species 7	7b	May 7
		Species 8	1d	Oct 20

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		Species 9	4a, 9a	Mar 5-25
		Species 10	4b	Mar 5
		Species 11	6a	May 2
		Species 12	1a	Sep 6
		Species 13	4a	Mar 5
		Species 14	1a, 3b	Apr 8-Aug11
		Species 15	3b	Apr 11
		Species 16	3b	Apr 11
	Anthophoridae			
		Species 1	9a	Mar 25
		Species 2	9a	Mar 25
		Species 3	6a	May 7
		Species 4	4a, 9a	Mar 5-25
		Species 5	7b	May 7
		Species 6	6a	Oct 5
		Species 7	1d	Oct 20
		Species 8	3b	Aug 11
		Species 9	7b	May 7
		Species 10	7b	Jun 29
		Species 11	2c	Mar 25
	Bethylidae			
		<i>Epyris</i> sp.	3b, 3d, 6a, 7a, 8a	Jun 29-Nov 20
		Species 1	6a, 7a, 8a	May 13-Aug 29
	Braconidae			
		Species 1	1a, 6a, 8a	Jul 16-Sep 14
		Species 2	7b	May 7
		Species 3	1a, 7a	Apr 8-May 7
		Species 4	1a	Oct 20
		Species 5	7a	Oct 12
		Species 6	2c	Mar 25
		Species 7	6a	May 2
		Species 8	4c	Mar 5
		Species 9	1a, 7a	Aug 29-Oct 20
		Species 10	1d	Oct 20
		Species 11	2a	Jan 29
		Species 12	3b	Apr 11
		Species 13	8a	Sep 14
	Chalcididae			
		* <i>Haltichella</i> sp.	6a	May 2
		<i>Hockeria</i>	8a	May 13
		*Species 6	6a	May 2
	Chrysididae			
		<i>Chrysis fuscipennis</i>	3a	Sep 21
		* <i>Hedychridium fletcheri</i>	2c, 9a	Mar 25
		* <i>Pseudomalus</i> sp.	3d	Sep 21
	Colletidae			
		Species 1	7a, 9b	May 7-13

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		Species 2	1a	Sep 6
	Encyrtidae	Species 4	6a, 7b, 8a	May 7-Oct 12
		*Species 5	7a, 8a	Jun 29-Jul 16
		*Species 6	8a	Sep 14
		*Species 7	7a	May 7
		*Species 8	6a, 7b	Aug 29-Oct 5
		*Species 9	1d	Apr 8
		*Species 10	6a	Aug 22
	Eulophidae	<i>Aprostecetus</i> sp. 1	4a, 6a, 7b, 8a, 9a	May 7-Oct 5
		<i>Aprostecetus</i> sp. 2	8a, 9a	Jul 16-Sep 20
		<i>Zagrammosoma americanum</i>	7a	May 7
		Species 1	1a, 3b, 7b, 9a	Apr 8-Sep 20
	Eupelmidae	Species 1	2d, 6a	Sep 14-Oct 5
		Species 2	7a	May 7
	Eurytomidae	<i>Eurytoma</i> complex	1a-b, 3b, 7a-b, 8a	Apr 22-Oct 20
		<i>Rileyia</i> sp.	1a, 6a, 7b, 8a, 9a	Apr 8-Sep 20
	Formicidae	<i>Camponotus semitestaceus</i>	2a, 2c, 3b	Jan 29-Nov 20
		<i>Crematogaster mormonum</i>	6a, 8a	May 13-Oct 5
		<i>Dorymyrmex bicolor</i>	1a	Feb 12-Oct 12
		<i>Formica pilicornis</i>	1a, 3a, 3d, 5c	Feb 19-Sep 21
		* <i>Formica subpolita</i>	3d	Sep 21
		* <i>Iridomyrmex pruinosus</i>	1d, 3a-b, 3d, 6a, 8a	Apr 8-Oct 5
		* <i>Leptothorax rugatulus</i>	1a	Feb 12
		<i>Messor pergandei</i>	4c, 6a-b	Aug 22-Oct 5
		* <i>Monomorium minimum</i>	1a, 4c	Feb 12-Mar 5
		<i>Myrmecocystus mexicanus</i>	6a, 7a, 8a	Jun 13-Oct 5
		<i>Myrmecocystus mimicus</i>	2a, 2c, 6a, 7a, 9a	Jan 29-May 22
		* <i>Pheidole hyatti</i>	3a, 5c	Feb 19-26
		<i>Pogonomyrmex rugosis</i>	1a, 2a, 2d, 3a, 7a-b, 9a	Feb 12-Oct 12
		<i>Pogonomyrmex californica</i>	2c, 3a-b, 4a, 6b, 7a, 8a, 9a	Mar 5-Nov 20
		<i>Solenopsis xyloni</i>	3a, 6b, 7a-b	Feb 26-Nov 20
	Gasterupidae	* <i>Gasteruption nevadae</i>	7a	May 7
	Halictidae	Species 1	3b	Aug 11
		Species 2	1a, 3b, 6a, 7a-b, 8a	May 7-Oct 5
	Ichneumonidae	<i>Compsocryptus</i> sp.	4b	Mar 5
		Species 1	2c, 9a	Mar 25
		Species 2	1a, 6b	May 3-Oct 20
		Species 3	2a, 4a, 6a	Jan 29-May 2

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		Species 4	2c	Mar 25
		Species 5	6a	May 2
		Species 6	9a	Mar 25
		Species 7	9a	Mar 25
		Species 8	2c	Mar 25
		Species 9	2c, 4a	Mar 5-25
		Species 10	1b	Oct 20
		Species 11	1a	Sep 6
		Species 12	1a	Apr 8
	Megachilidae			
		Species 1	2c, 3b, 6a, 7a-b	Mar 22-Aug 11
		Species 2	3b	Apr 11
		Species 3	1a	Apr 8
		Species 4	7a	May 7
		Species 5	1a	Apr 8
		Species 6	9a	Mar 25
	Mutillidae			
		<i>Chyphotes melaniceps</i>	7a, 8a, 9a	Jul 16-Aug 29
		<i>Chyphotes nubeculus</i>	1a	Sep 6
		* <i>Dasymutilla phaon</i>	1a	Jun 6
		* <i>Odontophotosis inconspicua</i>	1a, 7b	May 3-Sep 15
		<i>Sphaerophthalma blakei</i>	3a, 8a	Jul 16-Sep 21
		<i>Sphaerophthalma</i> sp. 1	3b, 8a, 9a	Apr 11-Aug 2
		*Species 1	7a, 9a	May 7-Sep 20
		*Species 2	7a, 8a	Jul 16-Sep 14
	Mymaridae			
		*Species 1	6a	May 2
	Orymyridae			
		Species 2	6a	Oct 5
	Perilampidae			
		Species 1	3b	Apr 11
		Species 2	7b	May 7
	Platyasteridae			
		* <i>Imostemma</i> sp.	6a	May 2-Oct 5
		* <i>Platyaster</i> sp.	2d, 6a, 7b, 8a	May 7-Oct 5
	Pompilidae			
		<i>Anoplius imbellis</i>	1b, 3b, 7b, 8a	Jun 13-Sep 6
		<i>Anoplius yucatanensis</i>	3b, 7a-b, 9a	May 7-Oct 12
	Pteromalidae			
		Species 1	2d, 3b, 6a, 7a-b, 8a, 9a	May 7-Nov 20
		Species 2	6a, 7a, 9b	May 2-13
		Species 3	1a-b, 1d, 4a, 7a-b, 9a	Mar 5-Oct 20
		Species 4	1a, 6a	Apr 8-Oct 5
		Species 5	6a, 7a	May 2-7
		Species 9	1d	Oct 20
	Scoliidae			
		<i>Campsomeris plumipes</i>	8a	Jul 16

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
		<i>Trissolcus</i> sp.	8a	Jul 16
	Sphecidae			
		<i>Ammophila alberta</i>	1d, 7a, 8a	May 13-Jul 16
		<i>Ammophila placida</i>	2c, 7a	Mar 25-May 7
		<i>Ammophila pruinosa</i>	6a, 7a, 8a, 9a-b	May 3-Oct 5
		* <i>Ammophila wrightii</i>	6b	May 3
		* <i>Anicistroma</i> sp.	6a	May 2
		* <i>Aphilanthops hispidus</i>	7a	May 7
		* <i>Astata nubecula</i>	6a	May 2
		* <i>Belomicrus eriogoni</i>	2d	May 13
		<i>Bembix americana</i>	3b	Aug 11
		* <i>Bembix sayi</i>	1a	Sep 6
		* <i>Bicyrtes capnoptera</i>	3b	Aug 11
		<i>Cerceris</i> np. 2	1a	Apr 8
		<i>Diondontus</i> sp.	1a, 3b	Apr 8-Jun 2
		<i>Entomognathus</i> sp. 1	3d, 7a	Jun 29-Sep 21
		<i>Entomognathus</i> sp. 2	3d	Sep 21
		<i>Fernaldina lucae</i>	8a	Jul 16
		<i>Microbembix argyropleura</i>	7b	Aug 29
		* <i>Mimesa cahuilla</i>	6a	May 2
		* <i>Ochleroptera</i> sp.	7b	May 7
		<i>Oxybelus argenteopilos</i>	3b	Apr 11
		<i>Oxybelus</i> sp. 1	1a	Sep 6
		<i>Podalonia deserticola</i>	1a-b, 5b, 7a-b, 8a, 9a	Feb 19-Oct 20
		<i>Prionyx parkeri</i>	7a-b	May 7
		<i>Sceliphron caementarium</i>	3a	Sep 21
		<i>Sphex ashmeadi</i>	6a	Aug 22
		<i>Steniolia duplicata</i>	1a, 3b, 7b, 8a, 9b	May 7-Sep 6
		<i>Tachysphex</i> sp.	6a	Jun 13
		<i>Tachytes erimineus</i>	7a	Jun 29
		<i>Tachytes</i> sp.	3b, 7b	Aug 11-Oct 12
		* <i>Trypoxylon aldrichi</i>	6a	May 2
	Tiphiidae			
		Species 1	3a, 6a, 7a, 8a, 9a	May 3-Oct 5
		Species 2	1a, 3b, 6a, 8a, 9a	Aug. 2-Oct 5
		Species 3	7a, 8a	May 23-Jul 16
		Species 4	6a, 7a, 8a	May 7-Aug 29
		Species 5	6a, 8a, 9a	Jul 16-Sep 14
		Species 6	1a, 3b, 6a	Apr 11-Sep 6
		Species 7	6b	May 3
		Species 8	1a, 3b, 7a	May 7-Sep 6
		Species 9	1a, 8a, 9a	May 13-Sep 6
		Species 10	8a	Jul 16
		*Species 11	4b	Mar 5
	Torymidae			
		Species 3	1a, 3b, 6a, 7a, 8a	Apr 22-Oct. 12
		Species 5	9a	Sep 20

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Localities</u>	<u>Date</u>
	Vespidae	*Species 7	7b, 8a	Oct 12
		* <i>Ancistrocercus lineativentris</i>	2c, 9a	Mar 25
		<i>Eucdynerus annulatus</i>	8a	Jul 16
		<i>Eucdynerus</i> sp. 1	1a, 3b, 8a	Jul 16-Sep 6
		* <i>Eucdynerus</i> sp. 2	3d, 7b, 8a, 9a	May 7-Sep 21
		<i>Leptochilus electus</i>	9b	May 13
		* <i>Leptachilus propodealis</i>	6b	May 3
		<i>Leptachilus</i> sp.	7b, 8a	May 7-Aug 29
		<i>Polistes fuscatus</i>	3a-b, 3d	Aug 11-Sep 21
		* <i>Stenodynerus pulviventis</i>	1a-b, 3b	Apr 11-Oct 20
		Species 1	7a	May 7
		*Species 2	7b	Aug 29

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 2000	3. REPORT TYPE AND DATES COVERED Final report	
4. TITLE AND SUBTITLE Terrestrial Invertebrates, Edwards Air Force Base, 1997			5. FUNDING NUMBERS	
6. AUTHOR(S) Gordon Pratt				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of California at Riverside Department of Entomology Riverside, CA 92521			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) See reverse.			10. SPONSORING/MONITORING AGENCY REPORT NUMBER ERDC/EL TR-00-3	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) An invertebrate survey was performed on Edwards Air Force Base during the 1997 season (November 1996 through December 1997), which was a continuation of a 1996 survey. Survey methods involved sweeping of blooming and nonblooming vegetation; searching for invertebrates beneath rocks, logs, and other objects; searching for diurnal and nocturnal crawling, flying, and calling invertebrates; and collecting nocturnal invertebrates drawn to a mercury vapor light. From this study, 769 invertebrate species were collected. A total of 297 species, nearly 40 percent, were new and had not been found last year. Of these species approximately 97 percent were insects and over 80 percent belonged to the four major insect orders: Coleoptera, Lepidoptera, Diptera, and Hymenoptera. Over 15 percent belonged to the next four major insect orders: Orthoptera, Homoptera, Hemiptera, and Neuroptera. Three new species of Gryllacrididae have been found by this survey. Two of the three <i>Cicindela</i> species collected were outside their reported range.				
14. SUBJECT TERMS Anthropods Invertebrates Survey Conservation Mojave Desert Environmental impacts Scorpions Insects Spiders			15. NUMBER OF PAGES 43	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

9. (Concluded).

Edwards Air Force Base
Edwards, CA 93523;
U.S. Army Engineer Research and Development Center
Environmental Laboratory
3909 Halls Ferry Road, Vicksburg, MS 39180-6199